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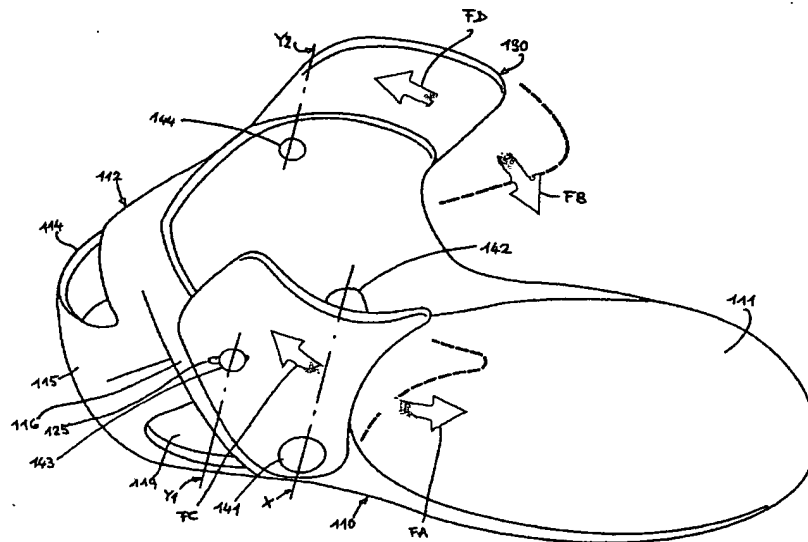
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(75) Inventor/Applicant (for US only): GABRIELLI, Andrea [IT/IT]; Via Fiamme Gialle, 7/A, I-38037 Predazzo (IT). For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ARTICULATED REINFORCEMENT STRUCTURE AND FOOTWEAR PROVIDED WITH SUCH A STRUCTURE



(57) Abstract: Articulated structure for the reinforcement of footwear articles, comprising a first rigid part (110), which comprises a sole (111) and an uprising portion (112) for the heel of the user, and a second and a third part (120, 130), arranged on opposite sides of said first part (110) with respect to the longitudinal centre-line plane. Each one of these parts is separately joined to said uprising portion (112) of the first part (110) so as to obtain independent forward movements (FA, FB) and rearward movements (FC, FD) of a limited extent thereof. USE: Sports footwear, work-shoes and the like. ADVANTAGES: improved movement freedom of the foot, while maintaining the desired side support function unaltered; improved manufacturability of the footwear.

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10 **ARTICULATED REINFORCEMENT STRUCTURE AND FOOTWEAR
 PROVIDED WITH SUCH A STRUCTURE**

DESCRIPTION

15 The present invention refers to an articulated reinforcement structure and the footwear articles, not only for sports applications such as ski boots and mountaineering boots, or the boots used in connection with skates with in-line rollers, cross-country-skiing, etc., but also work-footwear and the like, that are provided with such a structure.

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 A typical reinforcement structure for sports and similar footwear of the above cited kind - see patent publication US-A-5 437 466 - consists of a number of parts that are made as separately moulded pieces of polymeric materials having particularly strong mechanical properties. One of these parts is constituted by the sole, which in this particular case is fastened on to a support framework for a plurality of in-line rollers, a toe portion and an uprising rear portion that accommodates the heel by wrapping it up, whereas a second part is a leg-piece that is intended for supporting the ankle and is joined to said uprising rear portion of said first part by means of a pair of pins enabling it to pivotally move about an axis perpendicular to the longitudinal centre-line plane of the foot. In this way, the user is capable of bending his/her legs forwards and backwards, whereas the inherent rigidity of the parts ensure an effective side support to the foot minimizing the risk of sprains, when the leg-piece is duly tightened by means of appropriate

fastening devices.

The major drawback of an articulated structure of this kind lies in the fact that the foot is prevented from performing any other movement than the above cited pivoting movement, unlike what many users would on the contrary desire or appreciate. The construction-related complexity of the leg-piece, which is adapted to envelop the lower portion of the leg of the user all around it, i.e. on 360 degrees, and to a not negligible height thereof, is furthermore such as to require the use of sophisticated moulding tools and a relatively large amount of some premium-grade polymeric material that may be quite expensive.

It would therefore be desirable, and is actually a main object of the present invention, to provide an articulated reinforcement structure for footwear articles of the above mentioned kind that does away with the above cited drawbacks and that, in particular, ensures the user with a great freedom of movement of both the foot and the leg, without anyway impairing the inherent protection and support functions thereof to any extent whatsoever.

An articulated footwear reinforcement structure having the features as recited in the appended claims enables this and further objects to be reached, as this may be readily understood from the description given below by way of example of a preferred, although not sole embodiment of the present invention with reference to the accompanying drawings, in which:

- Figure 1 is a side view of an articulated footwear reinforcement structure according to the present invention;

- Figure 2 is a side view of a boot for a roller skate with in-line rollers, comprising the articulated reinforcement structure of Figure 1;

- Figures 3 and 4 are side views of a first and respectively a second part belonging to the same articulated footwear reinforcement structure; and

– Figure 5 is a three-dimensional top view of the same articulated footwear reinforcement structure.

According to the invention, an articulated footwear reinforcement structure,
5 as indicated generally at 100, comprises a first part 110, as well a second and a third part, which are generally indicated at 120 and 130, respectively (see Figures 4 and 5), in which each one of said parts is manufactured separately by injection moulding, or such other moulding technique as may be found appropriate, as individual moulded parts of polymeric materials having premium-grade mechanical
10 properties. In order to realize the articulated structure 100, said second and said third part 120, 130 are separately joined to said first part 110 by means of a first and a second pair of pins 141, 142 and 143, 144. The axis X of the first pair of pins 141, 142 has a fixed arrangement with respect to all three parts joined by the relevant pins, and is substantially coinciding with the axis of the malleoli (i. e. of
15 the ankle). The axes Y1, Y2 of the second pair of pins 143, 144 have on the contrary a fixed arrangement with respect to said first part 110 and a moving arrangement, albeit within certain limits as better explained further on, with respect to the other two parts 120, 130, wherein such an arrangement lies in all cases more in the rear with respect to and definitely above the axis X.

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The first part 110 of the structure 100 (see Figure 3) comprises a sole 11 and uprising portion 112 that, when seen from the top (see Figure 5), is substantially U-shaped since it is adapted to envelop the heel with the inner side 113, the outer side 114 and the zone 115 thereof, which comes to lie in
25 correspondence of the Achilles tendon owing to its being positioned between the sides 113, 114. On the exposed surface of the uprising portion 112, the first part 110 of the articulated reinforcement structure 100 is provided with a rib (of which only the one provided on the inner side 113 is shown, as generally indicated at 116, in the related Figures 3 and 5 of the accompanying drawing) having a curved
30 contour with forward and upward facing concavities, the function of which shall be more closely explained further on. On the same side 113 there are provided the round holes 117 for pin 141 along the axis X and 118 for pin 143 along the axis Y1. Similar holes (not shown) are provided on the outer side 114 for pin 142 along

the same axis X and for pin 144 along the axis Y2, respectively. It should finally be noticed that the uprising portion 112 of the first part 110 of the articulated reinforcement structure 100 is provided in a substantially *per se* known manner with through-apertures 119 in view of enhancing aeration for the foot of the user.

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Since the second part 120 and the third part 130 of the articulated reinforcement structure 100 are specular in their form and construction, only a description of said second part 120 is given herebelow with particular reference to Figure 4, for obvious reasons of greater simplicity,.

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The lower portion 121, in which there is provided a recess 122 intended for the head of the pin 141 and featuring a central round hole 123, which is adapted to be in due alignment with the afore mentioned hole 117 of the first part 110, forms a quite wide obtuse angle with the leg-piece portion 124, in which there is provided a curvilinear slot 125, which is adapted to be coupled with the afore mentioned hole 118 of the first part 110 for accommodating the pin 143. Owing to what has so been set forth above, the second part 120 and the third part 130 extend upwards to a greater height than said uprising portion 112 of the first part 110, i.e. well above the malleoli of the user as identifiable by the afore mentioned axis X of the pins 141, 142.

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Figure 2 illustrates, by way of example for this description, a footwear for roller skates with in-line rollers, in which said footwear, further to the articulated reinforcement structure 100, is constituted by a soft, flexible shoe 50 that is advantageously made as disclosed in a patent application filed jointly with the present one by this same Applicant. To the purposes of the present invention, suffice it to say that the shoe 50 comprises a vamp 51 and an leg-piece 52 that has a border 53 folded downwards so as to form a kind of pocket 54 intended for accommodating the whole portion of the articulated structure 100 that lies above the first pair of pins 141, 142, i.e. above the axis X. The fastening of the footwear on the front thereof is ensured not only by a lace 60, but also by a fastening device, as generally indicated at 70, which first of all comprises a strap 71, which constitutes the fixed element thereof and is brought out through a pair of vertical

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slots (such as the one shown in Figure 2 with reference numeral 55) after passing into the pocket 54 between the folded border 53 and the second part 120 of the articulated reinforcement structure 100, as well as into the pocket formed on the opposite side of the shoe 50 between the corresponding folded border and the third part 130 of the articulated reinforcement structure 100. At the protruding ends of the strap 71 there are attached the *per se* known elements of a lever system, which is also a part of the fastening arrangement 70 and comprises in turn a lever 73 and a serrated strap 74. In the finished footwear, the articulated reinforcement structure 100 is in this way prevented from separating from the shoe 50. When the fastening device is tightened, i.e. locked, the leg of the user is therefore shut in on the front side by the serrated strap 74 and, along the whole remaining portion of its circumference, by the strap 71.

The functionality ensured by the articulated reinforcement structure 100 according to the present invention can be best inferred from the illustration in Figure 5. The second part 120 and the third part 130 of such a structure are capable of forward pivoting movements (see arrows FA, FB) and backward pivoting movements (see arrows FC, FD) with respect to the first part 110 thereof, in a manner that is fully independent of each other, about the fixed axis X of the first pair of pins 141, 142, whenever the leg is bent. These pivoting movements are favoured by the action exerted upon the same parts 120, 130 by said strap 71. The sliding motion of the second pair of pins 143, 144 within the curvilinear slots 125, 126 guides said rotations and, at the same time, contributes to the lateral support of the leg and the foot, in particular when the axes Y1, Y2 of the second pair of pins 143, 144 are coincident, so as to avoid sprains. The afore mentioned side ribs, such as the one indicated at 116, contribute, jointly with said slots 125 and 126, to restrict the amplitude, i.e. extent of these pivoting movements.

The inherent advantages of the present invention can be summarized as follows:

- for the user, a far greater freedom of foot movement than in prior-art constructions, thanks to the possibility for the inner and outer sides of the footwear

to be pivotally moved independently of each other;

- again for the user, the preservation of the desired rigidity characteristics that ensure lateral support to both the foot and the lower portion of the leg;

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- for the footwear manufacturer, the possibility for uncomplicated, easy-made moulding tools to be used, in particular for said second and said third part of the articulated structure, and for the assembly process to be automated in respect not only of the various parts forming said articulated structure, but also in respect
10 of the joining of the latter with the soft, flexible shoe.

Although the above description refers to a preferred embodiment of the present invention, it will be readily appreciated that those skilled in the art may be capable of developing the above described articulated structure, and therefore
15 also the footwear provided therewith, in a number of different manners without departing from the scope of the present invention as defined by the appended claims.

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CLAIMS

1. Articulated footwear reinforcement structure, comprising a plurality of parts made of high-strength materials and pivotally joined to each other by means of pin means that enable them to pivotally move with respect to each other about a transversal axis of the foot, in which a first one (110) of said parts at least comprises a sole (111) and an uprising portion (112) having a substantially U-shaped configuration to envelop the heel of the user, **characterized in that** a second and a third part (120, 130), arranged on opposite sides of said first part (110) with respect to the longitudinal centre-line plane of the foot, are separately joined to said uprising portion (112) of said first part (110), **and in that** the corresponding pin means (141, 142, 143, 144) have a longitudinally and vertically staggered arrangement so as to limit the extent of the independent forward pivoting movements (FA, FB) and backward movements (FC, FD) which each of said second and said third part (120, 130) is capable of performing with respect to said first part (110).

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2. Articulated footwear reinforcement structure according to claim 1, **characterized in that** the height of said second and third parts (120, 130) exceeds the height of said uprising portion (112) of said first part (110).

3. Articulated footwear reinforcement structure according to claim 2, **characterized in that** said second and third parts (120, 130) have a height extending above the malleoli, i. e. the ankle of the user.

4. Articulated footwear reinforcement structure according to any of the claims 1 to 3, **characterized in that** the axis (X) of a first pair of said pin means (141, 142) has a fixed arrangement with respect to all parts (110, 120, 130) joined by them, the said arrangement being substantially coincident with the axis of the malleoli, i. e. of the ankle of the user.

5. Articulated footwear reinforcement structure according to any of the claims 1 to 4, **characterized in that** the axes (Y1, Y2) of a second pair of said pin means (143, 144) have a moving arrangement within curvilinear slots (125, 126) provided in at least one of said parts (110, 120, 130) joined by said pin means.

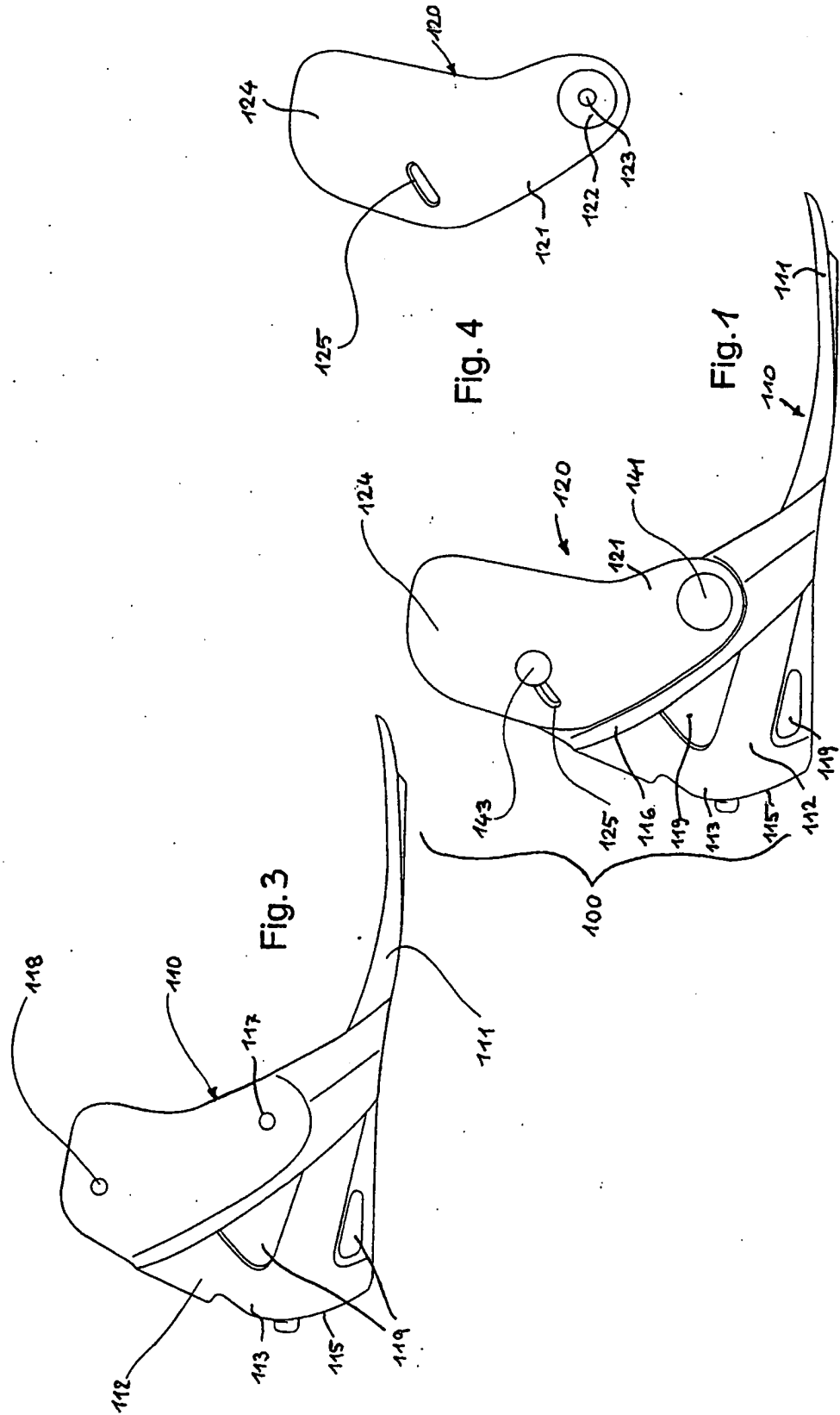
6. Articulated footwear reinforcement structure according to claim 5, **characterized in that** said curvilinear slots (125, 126) are provided in said second and said third part (120, 130).

7. Articulated footwear reinforcement structure according to any of the claims 1 to 6, **characterized in that** on the exposed surface of the uprising portion (112) of said first part (110) there is provided at least one retaining means (116) adapted to limit the amplitude of the independent pivoting movements that each of said second and third parts (120, 130) is capable of performing with respect to said first part (110).

8. Articulated footwear reinforcement structure according to any of the claims 1 to 7, **characterized in that** at least on said uprising portion (112) of said first part (110) there are provided apertures (119) adapted to enhance aeration of the foot of the user.

9. Footwear comprising an articulated reinforcement structure (100) according to any of the preceding claims, and a shoe (50) which is made of soft, flexible materials and is adapted to be fastened on its front side by means of fastening means, **characterized in that** said fastening means comprise associable means (71, 74) that are adapted to lock in the leg of the user all along

the circumference thereof, as well as to act upon said second and said third parts (120, 130) of the articulated structure (100) so as to favour the pivoting movements thereof with respect to said first part (110).



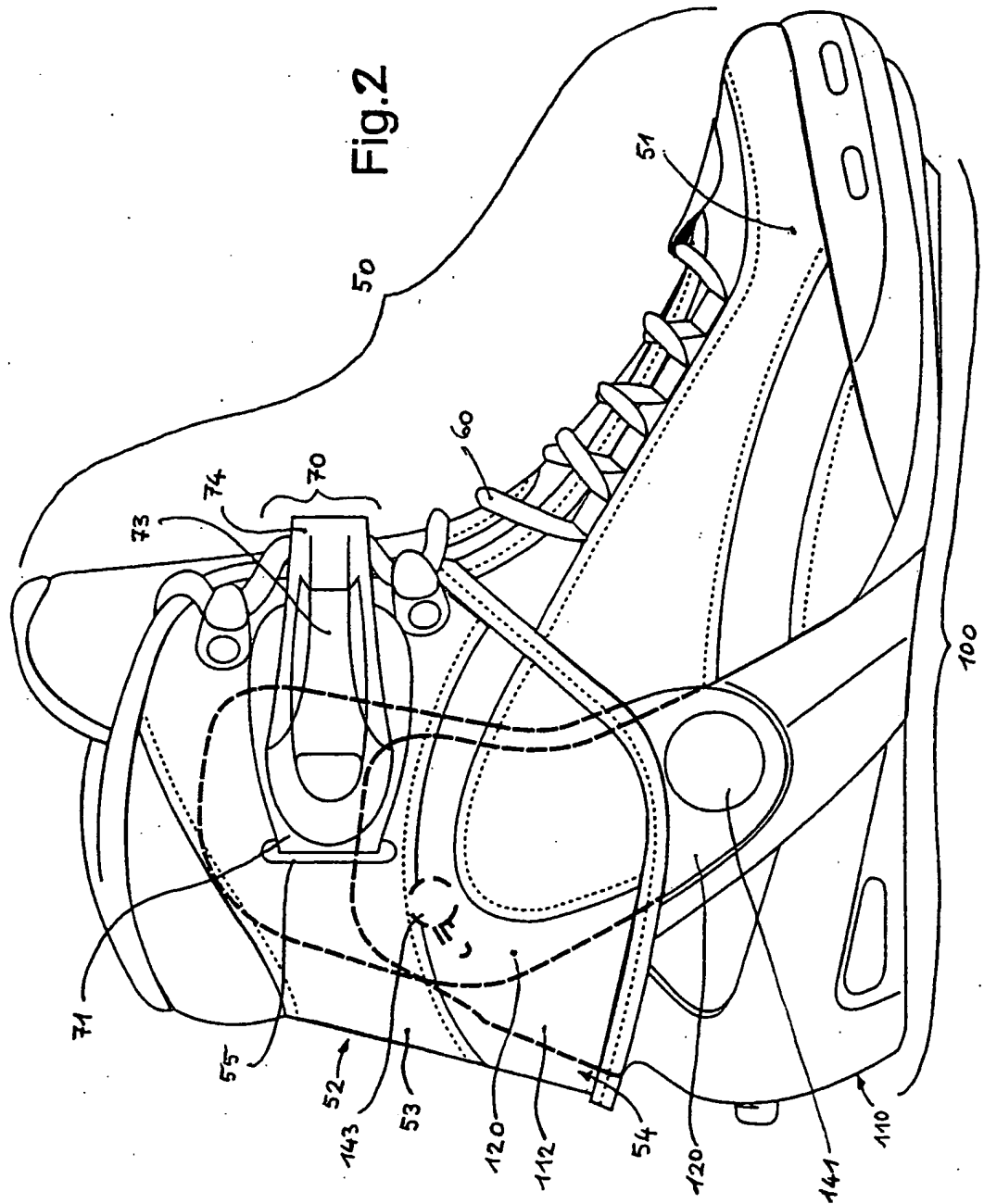
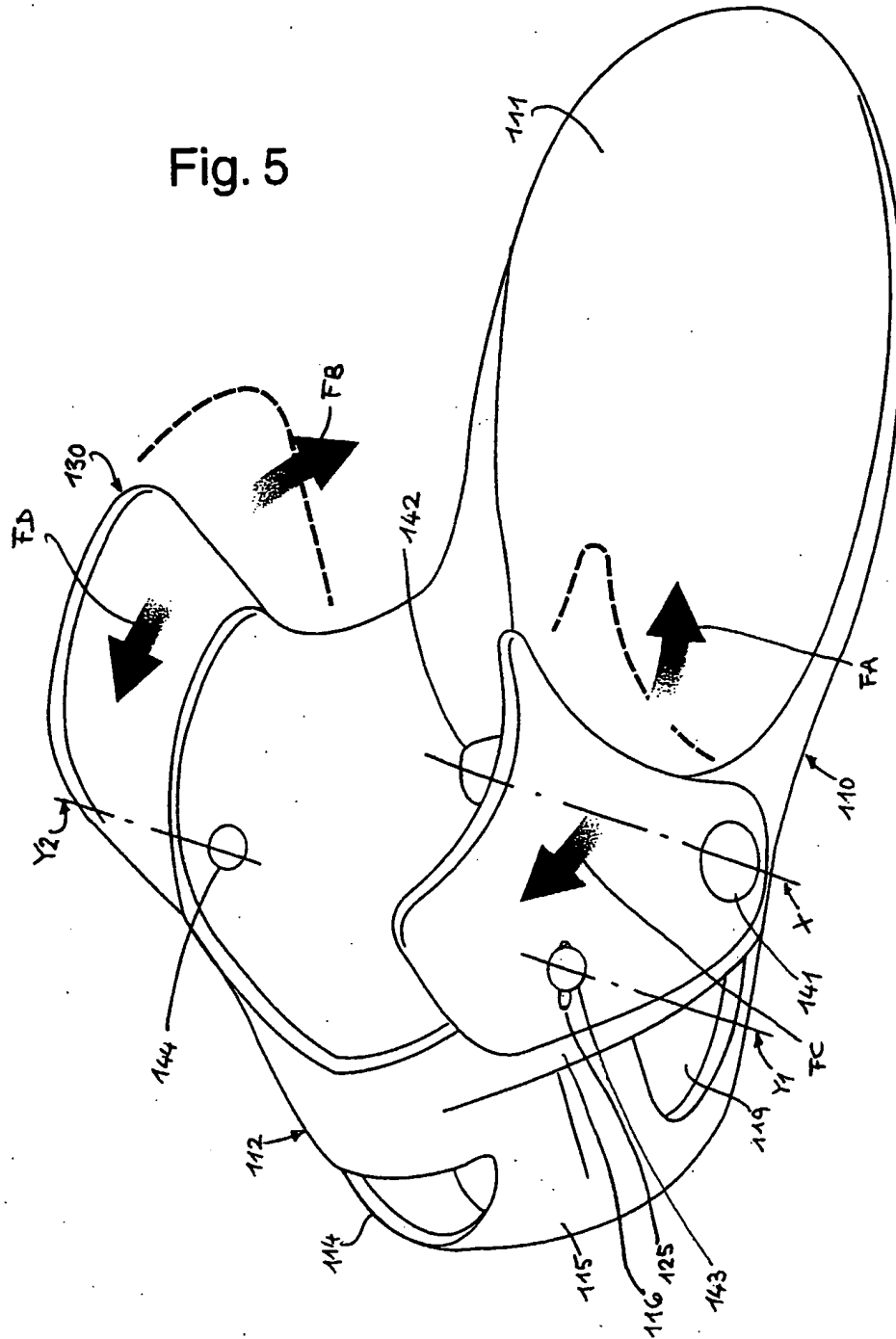


Fig. 5



INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 02/04199

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A43B5/04 A43B5/16 A43B7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 678 330 A (PRICE JOHN BENTON ET AL) 21 October 1997 (1997-10-21) column 9, line 16 -column 10, line 51; figures 7,8,14,15	1-4,9
A	FR 2 726 976 A (ROSSIGNOL SA) 24 May 1996 (1996-05-24) page 6, line 12 -page 9, line 15; figures 1-3	1-7,9
A	US 6 098 317 A (LAZZARONI ROBERT) 8 August 2000 (2000-08-08) column 3, line 26 -column 5, line 10; figures 1,3,4	1-4,9
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on patent family members



International Application No

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